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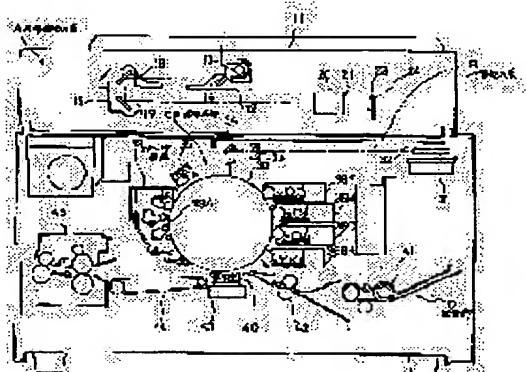
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(54) METHOD FOR FORMING MULTICOLOR IMAGE

(57)Abstract:

PURPOSE: To prevent color mixture from occurring and to improve the reproducibility of a character by making the grain size of the non-magnetic color toner of a second color larger than that of the non-magnetic color toner of a first color as for a multicolor image forming method in full color.

CONSTITUTION: An image carrier 30 is scanned by a beam modulated by a first chrominance signal and a latent image is formed. The latent image is developed by the developing device 36Y of yellowcolor toner and a toner image is formed on the surface of a drum. Next, write-in is executed on the surface of the drum by a second chrominance signal and the latent image is formed. The latent image is developed by a developing device 36M loading the toner of a magenta color as the second color. At this time, when the difference of the grain size between the first-color non-magnetic toner to be mixed and the second-color mixing non-magnetic toner is set to be 1.2. m, the color mixture is prevented from occurring even in a sufficiently wide AC developing bias area though a gap between a rotary sleeve for developing is set to be 0.1mm that the color mixture easily occurs.



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CLAIMS

[Claim(s)]

[Claim 1] By carrying out multiple-times rotation of the image support which can rotate, the aforementioned image support is received using two or more developers. by non-contact And a direct current, And impress AC-bias voltage, develop the color toner of a respectively different color, and this color toner is set to the image formation method which forms heavy doubling *****. The multicolor image formation method characterized by enlarging particle size of the aforementioned nonmagnetic toner according to the order of development when it has the developer which becomes two or more aforementioned developers from the nonmagnetic toner of a respectively different color from a magnetic carrier and negatives are developed by using the aforementioned nonmagnetic toner of the aforementioned developer for the aforementioned image support.

[Claim 2] The frequency of the aforementioned image support and the AC-bias voltage between the aforementioned developers is the multicolor image formation method according to claim 1 characterized by setting 100Hz - 20kHz and the voltage between peaks as 0.3-3.5kV.

[Claim 3] The multicolor image formation method according to claim 1 characterized by setting between the sleeves for development of the aforementioned image support and the aforementioned developer to 0.1-0.6mm.

[Claim 4] the account of before — the multicolor image formation method according to claim 1 characterized by having set the difference of average nonmagnetic toner particle size to 1 micrometers or more, and setting the mean particle diameter of the nonmagnetic toner greatest at all development processes to 20 micrometers or less at the process at which the nonmagnetic toner of a respectively different color develops negatives according to the aforementioned order of development

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001] [Industrial Application] this invention relates to the multicolor image formation method which imprints it for the detailed toner image of plurality [top / image support] in piles at imprint material, and forms a multicolor image about the multicolor image formation method by the xerography.

[0002] [Description of the Prior Art] Image formation by the above-mentioned xerography is realized by performing this twice or more by making electrification, image exposure, and development into 1 cycle on a conductive substrate on the image support which has a photoconduction layer. For example, JP.60-76786A. (Or the method, for example, JP.60-75850A., of performing them twice or more, using as 1 cycle the method of performing them twice or more using what prepared the penetrable insulating layer in the outside of a photoconduction layer as an image support, using primary electrification and secondary electrification simultaneous image exposure, uniform exposure, and development as 1 cycle or primary electrification, secondary electrification, image exposure, and development.) There is ***. Since each of these methods enables composition of the multicolor development on an image support, or an image and these superposition images can be imprinted to imprint material in the imprint process of 1 time, it becomes equipment with which a multicolor image and a synthetic image are obtained with easy composition.

[0003] It is required to carry out under the conditions indicated by JP.59-181362.A or the 62-52565 official report as the development method for this using the developer which consists of mixture of a nonmagnetic toner and a magnetic carrier, for example. Although this development method is a kind of the magnetic brush developing-negatives method, a magnetic brush is not contacted to an image support and it is characterized by making only a toner fly to the latent-image side of an image support by the AC bias.

[0004] As an example of the above image formation equipments, latent-image means forming forms a latent image according to a color, and there are some which are developed by the developer which uses the toner of a color which corresponded each latent image.

[0005] In such multicolor image formation equipment, what irradiates beams of light, such as laser, and forms an electrostatic latent image in the image support (it may be called a photo conductor below) which has the photoconductivity matter on a conductive substrate is typical. In such equipment, a multicolor image is formed with the multicolor image formation equipment shown in the block diagram of drawing 1.

[0006] Drawing 2 shows change of the surface potential of an image support, and the toner with which in PH the exposure section of an image support and DA adhered to the non-exposing section of an image support in the 1st development, and T1 adhered on the image support, the toner with which T2 adhered on the image support in the 2nd development, and DUP show a gone up part of the potential produced since the toner T1 adhered to the exposure section PH in the 1st development. Polarity of a latent image is made positive for explanation.

[0007] A Uniform electrification is given with an electrification vessel and an image support is taken as the positive fixed surface potential E.

[0008] B The first image exposure made into sources of exposure, such as laser, a cathode-ray tube, and Light Emitting Diode, is given, and the potential of the exposure section PH falls according to the quantity of light.

[0009] C The developer to which positive bias almost equal to the surface potential E of the unexposed section was impressed develops the electrostatic latent image formed by doing in this way. Consequently, the right electrification toner T1 adheres to the low exposure section PH of potential relatively, and the first toner image is formed. The field in which this toner image was formed does not usually become the unexposed section DA and this potential, although potential rises only in DUP when the right electrification toner T1 adhered.

[0010] D 2nd electrification is given with an electrification vessel, consequently the image support body surface in which the first toner image was formed next serves as the uniform surface potential E irrespective of the existence of a toner T1.

[0011] E Second image exposure is given to the front face of this image support, and an electrostatic latent image is formed in it.

[0012] F Development of the right electrification toner T2 of a different color from a toner T1 like Above C is performed, and the second toner image is obtained.

[0013] The same process as the following is performed the number of need times, and a multicolor toner image is obtained on an image support. This is imprinted to imprint material and a multicolor record picture is acquired by heating, or pressurizing and establishing this further. In this case, the toner and charge which remain on the front face of an image support are cleaned, and it is used for the next multicolor image formation.

[0014] The means which enlarges toner particle size according to the order of development further is indicated to the above multicolor image formation methods.

[0015] For example, it is a means to change the latent-image potential and direct-current development bias of each color to JP.58-82263A, and to form a picture. Moreover, it is the development method of 1 component jumping by the picture by the color toner of only JP.59-31971A.2 color. Furthermore, the method which develops two colors using 2 component MAG brush which contacts an image support also in JP.63-294579A is indicated respectively.

[0016]

[Problem(s) to be Solved by the Invention] As mentioned above, in the conventional multicolor image formation method, if the AC-bias frequency at the time of development is reduced to 5kHz or less in order to form a good picture when laying a toner on top of an image support body surface one by one as mentioned above and forming a multicolor image for example, character repeatability and thin-line repeatability will improve greatly. However, to the toner layer previously developed by the image support body surface when the formation process of the multicolor image by the above superposition was used, when the next development is performed, the color mixture to the non-picture section increases, and there is a fault in which quality of the image deteriorates. When negatives are especially developed with the diameter toner of a granule 8.5 micrometers or less, the above color mixture occurs notably. In that case, even if it adjusts the parameter of development electric field, i.e., frequency, the margin potential (initial electrification potential-direct-current development bias potential) of a fogging, etc. in the field in which character repeatability and development nature become good, color mixture occurs, and there is a fault which cannot obtain a good multi-colored picture image. Although the means which enlarges toner particle size one by one as a means to prevent such a fault, according to the order of development as mentioned above is indicated, it is a means to form a picture in the monochrome by two or less colors altogether.

[0017] this invention is the multi-colored picture image formation method which thought that the aforementioned fault should especially be improved and is depended in full color, and when laying a toner on top of image support dignity one by one and forming a multicolor image, it aims at offering a good full color picture by effective means to prevent color mixture.

[0018]

[Means for Solving the Problem] In order to attain the aforementioned purpose, the multicolor image formation method of this invention In a claim 1, the image support which can rotate by carrying out multiple-times rotation In the image formation method which is non-contact, and

impresses a direct current and AC-bias voltage to the aforementioned image support using two or more developers, develops the color toner of a respectively different color, and forms heavy doubling ***** for this color toner. When it had the developer which becomes two or more aforementioned developers from the nonmagnetic toner of a respectively different color or from a magnetic carrier and negatives were developed by using the aforementioned nonmagnetic toner of the aforementioned developer for the aforementioned image support, particle size of the aforementioned nonmagnetic toner was enlarged according to the order of development. In that the frequency of the aforementioned image support and the AC-bias voltage between the aforementioned developers set 100Hz ~ 20KHz and the voltage between peaks as 0.3~3.5kV in the claim 2, and also a claim 3 in having set between the sleeves for development of the aforementioned image support and the aforementioned developer to 0.1~0.6mm, and a claim 4 the account of before --- the difference of average nonmagnetic toner particle size was attained by having been referred to as 1 micrometers or more, and having set the mean particle diameter of the nonmagnetic toner greatest at all development processes to 20 micrometers or less at the process at which the nonmagnetic toner of a respectively different color develops negatives according to the aforementioned order of development

[0019]

[Example] Drawing 1 is what showed the main composition of the multi-colored picture image formation equipment of this invention, for A, a picture read system and B are [the image formation section and D of each unit of a laser write-in system and C] the feed sections, and a color picture is formed of the following process.

[0020] In the aforementioned read system A, 11 is a manuscript base, and the manuscript stored in this manuscript base 11 is illuminated with the attachment **** halogen lamp 13 by the carriage 12 slid horizontally the movable mirror unit 15 --- mirrors 16 and 17 --- attachment ***** --- similarly it slides horizontally and the light figure of a manuscript is derived to the lens read station 20 in combination with the attachment ***** mirror 14 on the aforementioned carriage 12

[0021] The aforementioned carriage 12 and the aforementioned movable mirror unit 15 are driven through the wire (neither is illustrated) linked to a stepping motor, and are slid in this direction at the rate of V and 1/2V, respectively.

[0022] The aforementioned lens read station 20 consists of a lens barrel 21 and CCD23.

[0023] Image formation of the light figure of the manuscript transmitted by the aforementioned mirrors 14, 16, and 17 is carried out to the light-receiving side of the above CCD 23 which converged by the aforementioned lens barrel 21 and was established on the read substrate 24. [0024] Therefore, in exposing the manuscript side of one sheet, scanning by the carriage 12 mentioned above and the movable mirror unit 15 is performed 4 times, and signal processing of each picture signal outputted from the above CCD 23 is carried out in the signal-processing section. In the signal-processing section, SHIENINGU amendment, gradation amendment, and dither processing are performed, the chrominance signal whose color was further separated according to the color separation filter (not shown) is outputted, and it is inputted into the aforementioned laser write-in system unit B which is an exposure means.

[0025] It is projected on the laser beam generated in semiconductor laser (not shown) in the laser write-in system unit B on the peripheral surface of the image support 30 to which the rotation scan was carried out by the polygon mirror 32 rotated with a drive motor 31, the optical path was bent by the mirror 34 through the Ftheta lens 33, and the charge was beforehand impressed with the electrification means slack electrification vessel 35, and it forms the bright line.

[0026] On the other hand, if a scan is started, a beam will be detected by the index sensor, the modulation of the beam by the picture signal through the color separation filter of the 1st chrominance signal, for example, blue, will be started, and the modulated beam scans the peripheral surface top of the aforementioned image support 30. Therefore, a latent image is formed on the peripheral surface of the image support 30 of horizontal scanning by the laser beam, and vertical scanning by rotation of the image support 30, and it goes. This latent image is developed by development counter 36Y loaded with the inner yellow color toner of a

development means, and a toner image is formed in a drum front face. The obtained toner image passes through the bottom of the cleaning means slack cleaning equipment 39 pulled apart from the peripheral surface of the image support 30 while it had been held in the drum side, and goes into the following copy cycle.

[0027] That is, the aforementioned image support 30 is again charged with the aforementioned electrification vessel 35, the picture signal through the 2nd chrominance signal (not shown), for example, green color-separation filter, subsequently outputted from the signal-processing section is inputted into the aforementioned write-in system unit B, the writing on the front face of a drum is performed like the case of the picture signal mentioned above, and a latent image is formed. A latent image is developed by development counter 36M which loaded with the toner of a Magenta color as the 2nd color.

[0028] The toner image of the yellow color of this Magenta color is formed in the bottom of existence of the toner image of the above-mentioned yellow color already formed.

[0029] Similarly, 36C and 36BK(s) are the development counters which have a cyanogen color toner and a black toner, respectively, and form a cyan color and a black toner image in a drum front face corresponding to a red filter (not shown) and a neutral density filter (not shown) based on the control signal generated in the signal-processing section. these --- each --- the bias of an alternating current and a direct current is impressed to the sleeve of development counter 36Y~36BK, and development is performed, without destroying the toner image which non-contact development by 2 component developer which is a ***** means was performed, and was previously formed in the grounded image support 30

[0030] The color picture formed on the peripheral surface of the image support 30 in this way is imprinted on the imprint pole 40 prepared as an imprint means by the record-medium slack recording paper sent with the feed belt 41 and the feed roller 42 from the aforementioned feed section D. The separation pole 43 dissociates from a drum front face, and the recording paper which had the toner image imprinted is carried in to fixing equipment 45 through the conveyance belt 44, and is established in a picture.

[0031] The toner which BURETO 39A of the aforementioned cleaning equipment 39, on the other hand, contacted the image support 30 which separated the recording paper from the drum peripheral surface, and remained is removed, and it waits for the end, is again pulled away from a drum peripheral surface, and goes into the process of new color picture formation. The composition of the multi-colored picture image formation method with which the above forms a full color picture using the multicolor image formation method of this invention is shown.

[0032] The rotation sleeve 363 for development is formed in the opening 362 for development which is 361 in drawing housing as shown in drawing 11, and was formed in this housing 361, and the composition of the aforementioned development counters 36Y, 36M, and 36C and 36BK makes the stationary magnet 364 which has the south pole by turns in this rotation sleeve 363 for development build in, churning in which 365,366 was prepared in housing 361 --- the two component developer D1 (only henceforth a developer) which consists of a nonmagnetic toner which is a member and was built in in housing 361, and a magnetic carrier is agitated, and the mixing ratio of a carrier and a toner is made to always equalize. The feed roller by which 367 supplies the aforementioned developer D1 to the aforementioned rotation sleeve 363 for development, 368 is the specification-part material for forming the supplied developer D1 in the 363rd page of the aforementioned rotation sleeve for development by the thin layer. On the other hand, to the 30th page of the aforementioned image support, with the rotation sleeve 363 for development, adsorb a developer D1 and it is conveyed by the stationary magnet 364 at the development section. After returning a developer D1 in housing 361 again after development, nonmagnetic toners run short in the magnetic carrier of a developer D1, the developer D1 to which it stuck by the stationary magnet 364 from the 363rd page of the rotation sleeve for development --- the nose of cam of ***** SUKUREPPA 368 --- the 363rd page of the aforementioned rotation sleeve for development --- ***** and the extra jacket ***** developer D1 --- the aforementioned churning --- it agitates by the member 365,366 and the toner of optimum dose is supplied in a carrier

[0033] the above and two churning --- a member 365,366 is a screw-like thing and performs

churning and conveyance of a developer by rotating in the direction of an arrow of drawing churning -- a member 365 -- the direction of space this side -- churning -- the member 366 is carrying out a configuration which is conveyed to a space back side The wall 361 is established so that a developer D1 may not pile up by both parts intermedia, and for this reason, exchange of a developer D1 is performed to a space longitudinal direction in this field.

[0034] toner supply to this developer 36 is performed from the near side of drawing 11 -- having -- churning -- a member 366 -- a space back side -- churning -- outline circulation is carried out to a space near side by the member 365, and the nonmagnetic toner and the magnetic carrier which are used for this invention are mixed uniformly However, a method which it is not limited to this and is uniformly supplied from the drawing 11 right-hand side to a sleeve shaft is sufficient as especially the position of toner supply.

[0035] 340 is bias power supply which impresses bias voltage to the aforementioned rotation sleeve 363 for development.

[0036] Full color development is performed using the development counters 36Y, 36M, and 36C constituted as mentioned above and 36BK.

[0037] As a resin used for the nonmagnetic toner which starts this invention in the aforementioned developer D1, a styrene resin, a vinyl system resin, an ethyl system resin, rosin modified resin, an acrylic resin, polyamide resin, an epoxy resin, polyester resin, etc. can be mentioned, a fixing disposition top agent, electrification control, etc. can be added to it if needed [such as carbon, / coloring agents or if needed], and it can make by the well-known toner particle manufacture method and the same method conventionally.

[0038] Furthermore, if a toner particle is globular--form--ized by the globular form-ized processing after particle[the spray-drying method or]-izing, the fluidity of a developer will improve, it will be hard coming to condense, and uniform miscibility and conveyance nature and electrification nature with a carrier will also improve.

[0039] As a coloring agent, although a color and a pigment are generally used, a pigment with weathering high fastness is used widely. As a pigment, the C.I. pigment blue -15, the C.I. pigment blue -15.2, the C.I. pigment blue -15.3, the C.I. pigment blue -16, the C.I. pigment blue -60, and C.I. pigment green 7 grade are mentioned as the cyanogen of black pigments, such as carbon black and graft-ized processing carbon black, and a color pigment, or a green pigment.

[0040] As a Magenta or a red pigment ** C.I. pigment red 2, C.I. pigment red 3, C.I. pigment red 5, C.I. pigment red 6, C.I. pigment red 7, C.I. pigment red 15, C.I. pigment red 16, and C.I. pigment red 48: 1, C.I. pigment red 53: 1, C.I. pigment red 57: 1, the C.I. pigment red 122, the C.I. pigment red 123, the C.I. pigment red 139, the C.I. pigment red 144, the C.I. pigment red 149, the C.I. pigment red 166, the C.I. pigment red 177, C. I. pigment red 178 and C.I. pigment red 222 grade are mentioned.

[0041] As yellow or an orange pigment, the C.I. pigment yellow 12, the C.I. pigment yellow 13, the C.I. pigment yellow 14, the C.I. pigment yellow 15, the C.I. pigment yellow 17, the C.I. pigment yellow 93, the C.I. pigment yellow 94, the C.I. pigment yellow 138, the C.I. pigment orange 31, and C.I. pigment orange 43 grade are mentioned.

[0042] According to a request, the selection combined use of the plurality is carried out, and organic [these] and an inorganic pigment are prepared by independent or the color tone to search for. Moreover, as for the addition of a pigment, the about 3 to 15 sections are preferably chosen from about 2 the about 20 sections to a resin.

[0043] Next, since the state of the developer layer formed on a development sleeve becomes rude, unevenness will tend to appear in a toner image and the toner concentration in a developer layer will become low even if it gives vibration by oscillating electric field if the mean particle diameter of a magnetic carrier is large, high-concentration development becomes difficult.

Moreover, if a carrier particle is too fine when the mean particle diameter of a carrier is small, it will become easy to cause adhesion in a photo conductor side, and scattering with a toner particle. These development is greatly related to the strength [the magnetic field strength made to act on the carrier particle as development conditions, and the carrier particle which answers it] of strengthening.

[0044] Moreover, the magnetic carrier particle may consist only of the magnetic substance, and

may cover the magnetic-substance particle with the resin.

[0045] As for the magnetic carrier of the two-component system developer which starts this invention above as a result of various examination, it is proper conditions that a mean particle diameter is [magnetic susceptibility] 20 - 50 emu/g in 30-80 micrometers and magnetic field 500 ERUSUTETTO.

[0046] As the magnetic substance used for the above magnetic carriers, the particle of the ferromagnetic called metal [such as iron, chromium, nickel, and cobalt] or those compound and alloys, for example, tri-iron tetraoxide, g--acid-ized second iron, chromium-dioxide, manganese oxide, ferrite, and manganese-copper system alloy or ***** is mentioned.

[0047] In addition, the effect of becoming possible for the developer layer formed on a development sleeve to become uniform, and to impress high bias voltage to a development sleeve is given by having formed especially the carrier particle with the resin etc. and having had a desirable spherical configuration. When the carrier particle is particle-ized with the resin etc., namely, to general (1) That the tropism which magnetization adsorption is easy to be carried out is lost in the direction of a major axis, a developer layer is uniformly formed in it, and the unevenness of the low valley of resistance or thickness occurs locally with height anti--** of (2) carrier particle to prevent Even if the edge section which is looked at by the conventional carrier particle will be lost, and concentration of the electric field to the edge section will not take place, consequently it impresses high bias voltage to a development sleeve, the prevention effect over the disturbance of the electrostatic latent image by the electric discharge to a photo conductor and breakdown of bias voltage is given. That this high bias voltage can be impressed can fully demonstrate the effect of high bias voltage in the development under the concussion electric field in this invention.

[0048] Furthermore, that in which the resistivity of a carrier particle formed the insulating magnetic particle especially more than 108-ohmcm so that it might be more than 1013-ohmcm is desirable. After this resistivity's putting a particle into the container which has the cross section of 2.050cm and tapping it, it is the current value when impressing the voltage which imposes the load of 1 kg/cm2 on the packed particle, and the electric field of 1000 V/cm produce between a load and a base electrode. this resistivity A low, When bias voltage is impressed to the development sleeve 2, a charge is poured into a carrier particle and adhesion of carrier ***** in a photo conductor or breakdown of bias voltage becomes easy to happen.

[0049] That is, a mean particle diameter is the globular form particle which is 30-80 micrometers, and a certain thing of 20 - 50 emu/g and resistivity is desirable [a magnetic carrier desirable to this invention] at the magnetic field of 500 ERUSUTETTO more than 1013 moreohmcm more than 108-ohmcm.

[0050] The developer which a toner and a magnetic carrier which were described above mixed at same rate also in the conventional 2 component developer is preferably used for this invention development mode.

[0051] The cleaning agent which is useful to the plasticizer for improving flow slipping of a particle or the cleaning of a photo conductor side, a fixing disposition top agent, a charge control agent, etc. are mixed by the developer if needed. As a plasticizer, colloidal silica, a silicone varnish, a metallic soap, or nonionic surfactant can be used, and surface active agents, such as a fatty-acid metal salt, organic machine substitution silicone, or a fluorine, etc. can be used as a cleaning agent.

[0052] A well-known thing is used as a fixing disposition top agent. Generally, a polyolefine system is used. For example, low molecular weight polyethylene, low molecular weight polypropylene, the oxidized polyethylene and polypropylene, the polyethylene by which acid denaturation processing was carried out, polypropylene, etc. are used. According to a conventional method, after fusing these, it can be made to be able to distribute underwater, and can add in the form of an emulsion at the time of an emulsion polymerization or a seed emulsion polymerization, and they can be introduced in a polymer particle. It is adding preferably at the time of a seed emulsion polymerization, and it is possible for you to make it exist in a particle front face as a particle of a polyolefine, and it is desirable from the meaning on a fixing disposition.

[0053] Furthermore, the polyethylene wax emulsion marketed as a tradename "HYTEC" (Toho Chemical Industry make) can be used for the same purpose.

[0054] The thing of well-known structure is similarly used for an electric charge control agent.

[0055] As an electrification control agent, the organic complex of electronic receptiveness, chlorinated paraffin, chlorination polyester, the sulfonyl amide of a copper phthalocyanine, etc. are mentioned as plus electrification nature as minus electrification nature, such as the metal salt of the electron-donative color of a Nigrosine system, a naphthenic acid, or a higher fatty acid, an alkoxyl-ized amine, quaternary ammonium salt, alkylamide, a metal complex, a pigment, and a fluorine processing activator.

[0056] In the multi-colored picture image formation equipment constituted as mentioned above, first as a range of the development conditions which perform good development in this invention The frequency *f* by the oscillating electric field of alternating current development bias at the time of reversal development 50Hz-30KHz (short form group), Dsd between 0.1-4.0kV, the aforementioned image support 30, and the rotation sleeve 363 for development changes [VP- P / voltage / between peaks] for 0.1-0.7mm. In Vdc-750V and the non-picture section potential VH, -850V and the picture section potential VL set [direct-current development bias] the linear velocity VS of -50V and the image support 30 as 140 mm/sec. About the developer D1, the diameter of a magnetic carrier changed 43.8 micrometers and nonmagnetic toner particle size to 7.9-25.2 micrometers, and toner-development nature adjusted toner concentration in 6 - 10% of the weight of the range here, in order [of a toner layer] to make it adhere above enough further at the 30th page of an image support. Next, when evaluating the character reappearance and the definition in a picture, the picture formed by the black toner performs. Moreover, when evaluating the inner color mixture state of a multicolor image, a yellow toner is poor-developed by one amorous glance, next, a black toner is developed on non-picture section electric-field conditions to a two-color eye by making this into a color mixture-ed toner, and it uses as a color mixture toner.

[0057] In case drawing 3 develops the latent-image section of the image support 30 using the aforementioned developer 36, it is data in which the field which pitch unevenness generates on a picture among alternating current development bias (frequency and voltage between peaks) conditions is shown. The black toner particle size *dt* used by the data shown in this drawing 3 is 8.1 micrometers, and if frequency is too low among alternating current development bias, pitch unevenness will generate it in a picture. The minimum is 100Hz as shown in drawing, and the dependency with the voltage between peaks or a development gap was not seen.

[0058] Next, drawing 4 shows the data which investigated like the above the field where character repeatability is good among alternating current development bias conditions by experiment. In these data, using 8.1 micrometers, as for development nature, frequency is improved like a low in the black toner particle size *dt*, so that between the image support 30 and the rotation sleeve 363 for development (i.e., Dsd) is narrow to this experiment as for ****.

Above Dsd becomes large to about 0.7mm, and if frequency is too high, a character will begin to become blurred, and the good field which performs character reappearance becomes narrow. Therefore, the upper limit of Above Dsd is 0.6mm, and the upper limits of frequency are 20KHz (s).

[0059] As mentioned above, although the interval of Dsd and the frequency of an AC bias are important for improving the definition of a picture, there is toner particle size as an important factor which determines character repeatability further. Although a definition improves and character repeatability becomes better as toner particle size is small, Table 1 is data which investigated the relation between toner particle size and a definition.

[0060]

[Table 1]

トナー粒径 (黒) μm	目視による解像性評価		
5.1	5	5	最良
8.1	5	5	"
11.5	4	4	良
15.2	4	4	"
20.2	3	3	普通
23.5	2	2	悪い
26.7	1	1	"

[0061] The above-mentioned table performed [a 8.0 line pair / mm, and duty ratio 50/50] image formation for writing on the recording paper by the laser aligner, using each toner particle size as a manuscript, the line drawing image formed of this image formation -- viewing -- evaluation of the definition -- best -- 5 -- right -- 4, the usual permissible level 3, and 2 [bad] -- inferior -- it divided into the criteria of 1 and judged Under the present circumstances, the set-up development bias changed VP-P of alternating current development bias, formed the poor picture for every toner particle size, and investigated and set up VP-P developed 1-1.5 layers for every toner particle size, as the conditions for other -- frequency 2KHz, Dsd 0.3mm, and direct-current development bias-750V -- un--- it was set as picture section potential-850V Consequently, when toner particle size was 20 micrometers or less, the picture which has a good definition was able to be acquired. Therefore, that 20 micrometers is an upper limit made toner particle size clear.

[0062] Using a black toner with a particle size of 8.1 micrometers, drawing 5 is what showed the good upper limit without the thunderbolt to the image support 30, changes AC-bias frequency and VP-P, and investigates the good picture form range at the time of making Dsd into a parameter. If Dsd is larger than this investigation, it will be hard coming to be struck by lightning, and the good image formation range is wide and a bird clapper is known. 0.6mm of Dsd is maximum from aforementioned drawing 4, therefore the upper limit of VP-P is 4kV.

[0063] Drawing 6 is data which investigated the range from which the good development nature developed one or more layers of toners in a solid picture using a black toner with a particle size of 8.1 micrometers is obtained. If Dsd sets it as a value narrower than the 0.6 aforementionedmm, electric field will become strong and the range of good development nature will become large. However, since a part of developer D1 on the aforementioned rotation sleeve 363 for development will contact the 30th page of the aforementioned image support if Dsd is made narrower than 0.1mm, Dsd cannot be set up smaller than 0.1mm or less. Therefore, when Dsd is set as 0.1mm, the VP-P minimum of the good range which the coating weight of a nonmagnetic toner can develop more than a part further is 0.3kV or more, is actually set up more than this and is used.

[0064] In here where the range of the good development conditions on which color mixture does not generate drawing 7 in Dsd 0.3mm is shown, after it exposes and develops color mixture to image support dignity and it forms a toner picture, it is that a toner unnecessary to the field which omits the next exposure to this picture side adheres. And the amount dependency of electrifications of the nonmagnetic toner which carries out color mixture is shown, toner particle size of the color mixture-ed nonmagnetic toner of one amorous glance and the color mixture nonmagnetic toner of two amorous glance was made the same, the amount of electrifications of the color mixture nonmagnetic toner of two colors was changed, and the range which color mixture does not generate was investigated. If the amount of electrifications of the color mixture nonmagnetic toner of the two aforementioned amorous glance is reduced first, although the amount of color mixture will decrease a little, the effect of color mixture prevention is seldom improved small. In this case, it experimented, using black (amount c/g of 19.2-35.2micro

particle-size electrifications of 8.1 micrometers) as two amorous glance (color mixture nonmagnetic toner), using yellow (particle size of 7.9 micrometers, amount c/g of 27.1micro of electrifications) as one amorous glance (color mixture-ed nonmagnetic toner).

[0065] Drawing 8, drawing 9, and drawing 10 show the good alternating current development bias range when enlarging the nonmagnetic toner of two amorous glance one by one.

[0066] The alternating current development bias field which extends to Dsd 0.6mm, and color mixture does not generate to color mixture prevention probably when advantageous when the particle-size difference of a color mixture-ed toner and a color mixture toner is set to 0.2 micrometers (7.9 micrometers of one amorous glance, 8.1 micrometers of two amorous glance) in drawing 8 in the case of Dsd 0.6mm, 0.3mm, and 0.1mm is very narrow. Next, when drawing 9 sets the particle-size difference of a color mixture-ed toner and a color mixture toner to 0.6 micrometers (7.9 micrometers of one amorous glance, 8.5 micrometers of two amorous glance), although the good field which does not carry out color mixture in Dsd 0.6mm, 0.3mm, and 0.1mm spreads, it is still narrowly inadequate. [of the range of color mixture prevention]

[0067] When the particle-size difference of color mixture-ed and a color mixture toner was set to 1.2 micrometers (7.9 micrometers of one amorous glance, 9.1 micrometers of two amorous glance) in drawing 10, even if it set it as Dsd 0.1mm which begins and is easy to carry out color mixture generating, in the latus alternating current development bias field, color mixture prevention was completely attained enough. Therefore, color mixture can be completely prevented because the particle-size difference of a color mixture-ed toner and a color mixture toner sets to 1 micrometers or more like drawing 10.

[0068]

[Effect of the Invention] When this invention is non-contact, and impresses direct and AC-bias voltage to an image support using a developer, and develops the nonmagnetic color toner of a respectively different color as mentioned above and heavy doubling ***** is formed for this nonmagnetic color toner, A high definition full color picture can be acquired by preventing color mixture and using good development electric-field fields, such as character repeatability, by making nonmagnetic color toner particle size of two amorous glance larger than the nonmagnetic color toner of one amorous glance.

[Translation done.]

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- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.*** shows the word which can not be translated.
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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

- [Drawing 1] The block diagram of the whole multi-colored picture image formation equipment using the developer of this invention.
- [Drawing 2] The flow chart which shows change of the surface potential of an image support, and the development of a toner.
- [Drawing 3] The property view showing a relation with Dsd in AC-bias frequency and VP-P.
- [Drawing 4] The property view showing the relation between AC-bias frequency and VP-P, and Dsd of a nonmagnetic toner.
- [Drawing 5] Other property views showing the relation between AC-bias frequency and VP-P, and Dsd of a nonmagnetic toner.
- [Drawing 6] Other property views showing the relation between AC-bias frequency and VP-P, and Dsd of a nonmagnetic toner.
- [Drawing 7] The property view showing the relation between AC-bias frequency and VP-P and development conditions, and Dsd.
- [Drawing 8] Other property views showing the relation between AC-bias frequency and VP-P and development conditions, and Dsd.
- [Drawing 9] Other property views showing the relation between AC-bias frequency and VP-P and development conditions, and Dsd.
- [Drawing 10] Other property views showing the relation between AC-bias frequency and VP-P and development conditions, and Dsd.
- [Drawing 11] The cross section of the developer used for this invention.

[Description of Notations]

- A Picture read system
- B Laser write-in system unit
- C Image formation section
- D Feed section
- 11 Manuscript Base
- 20 Lens Read Station
- 21 Lens Barrel
- 23 CCD
- 30 Image Support
- 36 Developer
- 363 Sleeve
- 369 Direct Current, Alternating Current Development Bias
- 365 and 366 churning --- member

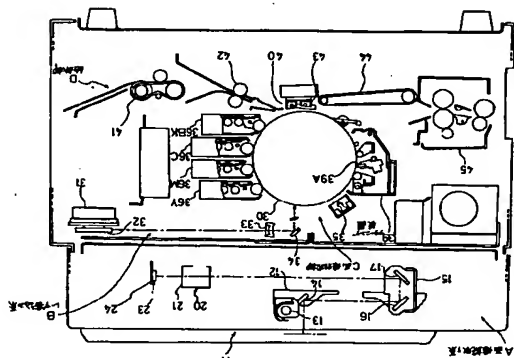
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(54) 【発明の名称】 多色像形成方法

(57) 【要約】
【目的】 本発明はフルカラーによる多色画像形成方法で、順次像担持体面にトナーを重ね合わせて多色像を形成するとき、流色を防止する有効な手段により良好なフルカラー画像を提供することを目的としている。
【構成】 回転可能な像担持体を複数回転させることにより、複数の現像装置を用いて前記像担持体に対し非接触で且つ直流、及び交流バイアス電圧を印加し、各々異なる色のカラートナーを現像し、該カラートナーを重ね合わせて多色像を形成する像形成方法において、前記複数の現像装置には磁性キャリアと各々異なる色の非磁性トナーよりなる現像剤を有し、前記像担持体に前記現像剤の前記非磁性トナーを用いて現像を行う時、現像剤に従って前記非磁性トナーの粒径を大きくしたことを特徴とする多色像形成方法。



- (2) 特開平6-348100
- 1
- 【特許請求の範囲】
【請求項1】 回転可能な像担持体を複数回転させることにより、複数の現像装置を用いて前記像担持体に対し非接触で且つ直流、及び交流バイアス電圧を印加し、各々異なる色のカラートナーを現像し、該カラートナーを重ね合わせて多色像を形成する像形成方法において、前記複数の現像装置には磁性キャリアと各々異なる色の非磁性トナーよりなる現像剤を有し、前記像担持体に前記現像剤の前記非磁性トナーを用いて現像を行う時、現像剤に従って前記非磁性トナーの粒径を大きくしたことを特徴とする多色像形成方法。
【請求項2】 前記像担持体と、前記現像装置間の交流バイアス電圧の周波数は100Hz〜200Hz、ピーク間電圧を0.3〜3.5kVに設定したことを特徴とする請求項1記載の多色像形成方法。
【請求項3】 前記像担持体と前記現像装置の現像用スリープ間を0.1〜0.6mmとしたことを特徴とする請求項1記載の多色像形成方法。
【請求項4】 前記各々異なる色の非磁性トナーは前記現像剤に従って現像を行なう工程で平均非磁性トナー粒径の差は、1μm以上とし、且つ全現像工程で最大の非磁性トナーの平均粒径を20μm以下としたことを特徴とする請求項1記載の多色像形成方法。
【発明の詳細な説明】
【0001】
【産業上の利用分野】 本発明は電子写真法による多色像形成方法に関し、詳しくは像担持体上に複数のトナー像を重ねてそれを転写材に転写して多色像を形成する多色像形成方法に関する。
【0002】
【従来の技術】 上述の電子写真法による像形成は導電性基板上に光導電層を有する像担持体上で帯電、像露光、現像を1サイクルとしてこれを2回以上行なうことにより実現される。例えば特開昭60-76766号公報、あるいは像担持体として光導電層の外側に透過性の絶縁層を設けたものを用いて、一次帯電、二次帯電同時露光、一様な露光、現像を1サイクルとして2回以上行なう方法、または、一次帯電、二次帯電、露光、現像を1サイクルとして2回以上行なう方法、例えば特開昭60-75850号公報、などがある。これらの方法はいずれも像担持体上の多色像や像の合成を可能とするもので、これらの重ね合わせは1度の転写プロセスで転写材に転写できる場合、簡単な構成で多色像や合成像が得られる装置となる。
【0003】 このための現像方法としては、例えば非磁性トナーと磁性キャリアの混合体からなる現像剤を用いて特開昭59-181362号公報、あるいは同昭52-5565号公報に記載された条件下で行なうことが必要である。この現像方法は磁気ブラシ現像法の一つであるが、磁気ブラシを像担持体に接触せず、交流バイアスによりトナーのみを像担持体の潜像面へ飛翔させることを特徴とする。
【0004】 上述のような像形成装置の一例としては潜像形成手段が色別に潜像を形成し、それぞれの潜像を対応した色のトナーを用いている現像装置で現像するものがある。
【0005】 このような多色像形成装置においては、導電性基板上に光導電性物質を有する像担持体（以下感光体という場合もある）にレーザなどの光線を照射して潜電潜像を形成するものが代表的である。このような装置においては、図1の構成図に示す多色像形成装置で多色像が形成される。
【0006】 図2は像担持体の表面電位の変化を示したものであり、図3は像担持体の露光部、DAは像担持体の非露光部、T₁は第1回目の現像で像担持体上に付着したトナー、T₂は第2回目の現像で像担持体上に付着したトナー、DNPは露光部に第1回目の現像でトナーT₁が付着したため生じた電位の上昇分を示す。説明のため潜像の極性を正とする。
【0007】 A 像担持体は帯電器により一様な帯電が施されて、一定の正の表面電位Eとする。
【0008】 B レーザ・露光管・LEDなど露光源とする第一の露光光が与えられ、露光部内の電位はその光量に応じて低下する。
【0009】 C このようにして形成された静電潜像を、未露光部の表面電位Eにほぼ等しい正のバイアスを印加された現像装置で現像する。その結果、正帯電トナーT₁が相対的に電位の低い露光部内に付着し、第一のトナー像が形成される。このトナー像が形成された露光部は、正帯電トナーT₁が付着したことにより電位がDU Pだけ上昇するが、通常は未露光部D Aと同電位にはならない。
【0010】 D 次に第一のトナー像が形成された像担持体表面は帯電器により2回目の帯電が施され、その結果、トナーT₁の有無にかかわらず、均一な表面電位Eとなる。
【0011】 E この像担持体の表面に第二の露光光が施されて静電潜像が形成される。
【0012】 F 前記Cと同様にしてトナーT₁とは異なる色の正帯電トナーT₂の現像が行われ第二のトナー像が得られる。
【0013】 以下同様のプロセスを必要回数行なって像担持体上に多色トナー像を得る。これを転写材に転写し、さらにこれを加熱または加圧して定着することにより多色転写画像が得られる。この場合には像担持体の表面に残留するトナー及び電荷をクリーニングして次の多色像形成に用いられる。
【0014】 以上のような多色像形成方法に対し、更に現像順に従ってトナー粒径を大きくする手段が提示されている。
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- 40
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【0015】例えば特開昭58-82263号公報には各色の増倍電圧、及び電圧増倍ハイアスを変化させて画像を形成する手段である。又特開昭59-1971号公報2色のみのカラー用トナーによる画像で1成分ジャンピングの現像方式である。更に特開昭63-294579号公報においても像担持体に増倍する成分増倍電圧を用いて2色の現像を行なう方式が各々開示されている。

【0016】

【発明が解決しようとする課題】前記のように、従来の多色像形成方法において、前記のように像担持体表面に順次トナーを重ね合せて多色像を形成するとき、例えば良好な画像を形成するため現像時の交流ハイアス周波数を5kHz以下に低下させると文字再現性、細線再現性が大きく向上する。しかるに前記のような重ね合わせによる多色像の形成プロセスを使用したとき、先に像担持体表面に現像されたトナー層に対し、次の現像を行ったとき、非面像部に対する湿色が増加し、画質が劣化してしまう点がある。特に8.5 μ m以下の小粒径トナーで現像を行った場合に、前記のような湿色が顕著に発生する。その際、現像電流のパラメータ即ち、周波数、かぶりのマージン電位（初期帯電電位一直流現像ハイアス電位）などを文字再現性、現像性が良好となる領域で調整しても湿色が発生し、良好な多色像を得ることができない欠点がある。このような欠点を防止する手段として、前記のようにトナー粒径を現像順に従って順次大きくする手段が開示されているが、総て2色以下による単色で画像を形成する手段である。

【0017】本発明は前記欠点を改善すべく特に考えられたものでフルカラーによる多色像形成方法で、順次像担持体表面にトナーを重ね合せて多色像を形成するとき、湿色を防止する有効な手段により良好なフルカラー画像を提供することを目的としたものである。

【0018】

【課題を解決するための手段】前記目的を達成するために、本発明の多色像形成方法は、請求項1において、回転可能な像担持体を搭載回転することにより、複数の直の現像装置を用いて前記像担持体に対し非接触且つ直流、及び交流ハイアス電圧を印加し、各々異なる色のカラー用トナーを現像し、該カラー用トナーを重ね合せて多色像を形成する像形成方法において、前記複数の現像装置には磁性キャリアと各々異なる色の非磁性トナーよりなる現像剤を有し、前記像担持体の前記非磁性トナーを用いて現像を行う時、現像順に従って前記非磁性トナーの粒径を大きくしたこと、請求項2において、前記像担持体と、前記現像装置間の交流ハイアス電圧の周波数は100Hz～200Hz、ピーク間電圧を0.3～3.5kVに設定したこと、更に請求項3において、前記像担持体と前記現像装置の現像用スリフ間を0.1～0.6mmとしたこと、請求項4において、前記各々異なる色の非磁性トナーは前記現像順に従って現像を行なう工程で平均非

磁性トナー粒径の差は、1 μ m以上とし、且つ全現像工程で最大の非磁性トナーの平均粒径を20 μ m以下としたことにより達成された。

【0019】

【実施例】図1は本発明の多色画像形成装置の主要構成を示したものでAは画像増倍系、Bはレーザ増倍系、各ユニットまたはCは画像形成部、Dは給紙部であり、次のプロセスによりカラー画像が形成されるようになっている。

10 【0020】前記増倍系Aにおいて11は原稿台で、該原稿台11に収められた原稿は水平方向にスライドするキヤリッジ12に取付けられたハログランランプ13によって照明される。可動ミラーユニット15にはミラー16及び17が取付けられていて、同じく水平方向にスライドして、前記キヤリッジ12に取付けられているミラー14との組合せで原稿の光像をレンズ増倍部20へと導出する。

20 【0021】前記キヤリッジ12と前記可動ミラーユニット15はステッピングモーターに接続するワイヤ（向れも図示せず）を介して駆動され、それぞれV及び1/2Vの速度にて同方向にスライドされるものである。

【0022】前記レンズ増倍部20はレンズ鏡組1、C D23から構成される。

【0023】前記ミラー14、16及び17により伝達された原稿の光像は、前記レンズ鏡組1により集束され増倍部20に取付けられた前記C D23の受光面に結像される。

【0024】従って1枚の原稿面を露光するに当たっては前記キヤリッジ12と可動ミラーユニット15によるスキヤニングが4回行われ、前記C D23から出力された各画像信号は信号処理部において信号処理される。信号処理部において、シェーディング補正、階調補正、ディザ処理が行われ、更に色分解フィルタ（図示せず）に依り色分解された色信号が出力され、露光手段である前記レーザ増倍系ユニットBに入力される。

【0025】レーザ増倍系ユニットBにおいては半導体レーザ（図示せず）で発生されたレーザビームは駆動モータ31により回転されるポリゴンミラー32によって回転走査され、F θ レンズ33を経てミラー34により光路を曲げられて、予め増倍手段たる帯電器35によって電荷を印加された像担持体30の画面上に投射され輝線を形成する。

40 【0026】一方で走査が開始されるとビームがインテックスセンサによって検知され、第1の色信号例えば青の色分解フィルタを通して画像信号によるビームの走査が開始され、変調されたビームが前記像担持体30の画面上を走査する。従ってレーザビームによる主走査と像担持体30の回転による副走査により像担持体30の画面上に増倍が形成されて行く。この増倍は現像手段の内エロー色トナーの塗布された現像器36Yにより現像され、ドラム表面にトナー像が形成される。得られたトナー像はドラム面に保持されたまま像担持体30の画面上より

引き離されている増倍手段たるクリーニング装置39の下を通し、つぎのコピャーサイクルに入る。

【0027】すなわち、前記像担持体30は前記帯電器35により再び帯電され、次いで信号処理部から出力された第2の色信号例えば緑の色分解フィルタ（図示せず）を通して画像信号が前記増倍系ユニットBに入力され、前述した画像信号の組合せと同様にスライドドラム表面への書込みが行われ増倍が形成される。増倍は第2の色としてマゼンタ色のトナーを塗布した現像器36Mによって現像される。

【0028】このマゼンタ色のイエロー色のトナー像はすでに形成されている前述のイエロー色のトナー像の存在下に形成される。

【0029】同様にして36C及び36Bはそれぞれシア青色トナー及び黒色トナーを有する現像器で、信号処理部で発生する増倍信号に基づいてドラム表面に赤フィルタ（図示せず）、及びニュートラルフィルタ（図示せず）に対応してシア青色及び黒色のトナー像を形成する。これら各現像器36Y～36Bのスキューには交流及び直流のハイアスが印加され、露光手段である2成分現像剤による非接触現像が行なわれ、増倍された像担持体30には先に形成されたトナー像を破壊することなく、現像が行われるようになっている。

【0030】かくして像担持体30の画面上に形成されたカラー画像は露光手段として設けられた転写機40において、前記像担持体30より給紙ベルト41、給紙ローラ42により送り送られた記録紙に転写される。トナー像は転写された記録紙は分離機43によりドラム表面から分離されて、搬送ベルト44を介して定着装置45に搬入され画像の定着を行なう。

【0031】一方、記録紙をドラム周面より分離した像担持体30には、前記クリーニング装置39のブレード39Aが接触して残留したトナーの除去を行い、その終了をまって再びドラム周面より引き離され、新たなカラー画像形成のプロセスに入る。以上が本発明の多色像形成方法の構成を示したものである。

【0032】前記現像器36Y、36M、36C、36Bの構成は図1に示すように図中361ハウジングで、該ハウジング361に形成された現像用開口部362に現像用回転スリフ363が設けられ、該現像用回転スリフ363内にS極を交互に有する固定磁石364を内蔵させる。365、366はハウジング361内に設けられた増倍部材で、ハウジング361内に内蔵された非磁性トナーと磁性キャリアよりなる二成分現像剤D₁（以下単に現像剤と言う）を混合し、キャリアとトナーの混合比を常に平均化させている。367は前記現像剤D₁を前記現像用回転スリフ363に供給する供給ローラ、368は供給された現像剤D₁を前記現像用回転スリフ363面に薄層で形成するための規制部材であり、一方前記像担持体30面に現像用回転スリフ36

3で現像部に現像剤D₁を固定磁石364で吸着して搬送し、現像後再びハウジング361内に現像剤D₁を戻し、現像剤D₁の磁性キャリア内に非磁性トナーが不足しており、現像用回転スリフ365面より固定磁石364により吸着した現像剤D₁を掻取るスクレップ368の先端を前記現像用回転スリフ363面に安当て、掻取られた現像剤D₁は前記増倍部材365、366で増倍し、キャリア内に適量のトナーを供給する。

【0033】前記、二つの増倍部材365、366はスクレップ一枚のもので、図の矢印方向に回転することにより、現像剤の増倍及び搬送を行なう。増倍部材365は紙面手前方向へ、増倍部材366は紙面奥側へ搬送されるような形状をしている。両者の中間部で現像剤D₁が残留しないように壁3611が設けられていて、このためこの領域で紙面左右方向に現像剤D₁の交換が行なわれる。

【0034】この現像装置36へのトナー補給は図11の手前側から行なわれ、増倍部材365により紙面奥側へ、増倍部材366により紙面手前側へと暫時増倍し、本発明に用いられる非磁性トナーと磁性キャリアが均一に混合される。しかし、トナー補給の位置は特にこれに限定されるものではなく、例えば図11右側よりトナー補給に対しては、トナー補給するよう方法でもよい。

【0035】340は前記現像用回転スリフ363にバイアス電圧を印加するハイアス電源である。

【0036】以上のように構成された現像器36Y、36M、36C、36B Kを用いてフルカラー現像を行なう。

【0037】前記の現像剤D₁においては本発明に係る非磁性トナーに用いられる樹脂としては、ステレン系樹脂、ビニル系樹脂、エチル系樹脂、ロジン変性樹脂、アクリル系樹脂、ポリアミド樹脂、エポキシ樹脂、ポリエーテル樹脂等が挙げられ、それにカーボン等の増倍剤や必要に応じて定着性向上剤、帯電制御等を加えて、従来公知のトナー粒子製造方法と同様の方法によって作ることができる。

【0038】さらに、トナー粒子がスプレードライ法、あるいは粒子化後の球形処理によって球形化されたものであると、現像剤の流動性が向上して感度しにくくなる。キャリアとの均一混溶性、搬送性及び帯電性も向上する。

【0039】着色剤としては、一般に染料及び顔料が用いられるが、耐擦度が高い顔料が広く用いられる。顔料としては、カーボンブラック、グラフト化処理カーボンブラック等の黒色の顔料、又カラー顔料のシア又はグリーン顔料としてはC、I、ビグメントブルー-1、5、C、I、ビグメントブルー-15；2、C、I、ビグメントブルー-15；3、C、I、ビグメントブルー-1、ビグメントブルー-60、C、I、ビグメントブルー-7が挙げられる。

【0040】マゼンタ又はレッド顔料としてはC、I、ビグメントレッド2、C、I、ビグメントレッド3、

C. I. ビグメントレッド5、C. I. ビグメントレッド6、C. I. ビグメントレッド7、C. I. ビグメントレッド15、C. I. ビグメントレッド16、C. I. ビグメントレッド48:1、C. I. ビグメントレッド53:1、C. I. ビグメントレッド57:1、C. I. ビグメントレッド122、C. I. ビグメントレッド123、C. I. ビグメントレッド139、C. I. ビグメントレッド149、C. I. ビグメントレッド166、C. I. ビグメントレッド177、C. I. ビグメントレッド178、C. I. ビグメントレッド222等が挙げられる。

[0041] イエロー又はオレンジ顔料としては、C. I. ビグメントイエロー12、C. I. ビグメントイエロー13、C. I. ビグメントイエロー14、C. I. ビグメントイエロー15、C. I. ビグメントイエロー17、C. I. ビグメントイエロー93、C. I. ビグメントイエロー94、C. I. ビグメントイエロー138、C. I. ビグメントイエロー31、C. I. ビグメントオレンジ43等が挙げられる。

[0042] これら有機及び無機顔料は所望に応じて単独又は複数を選択併用して、求める色調に調えられる。又顔料の添加量は樹脂に対して約2から約20部、好ましくは約3から15部が選択される。

[0043] 次に磁性キャリアの平均粒径が大い、現象スリープ上に形成される現象層の状態で現れ易く、運動電圧で運動を与えてもトナー像にむらが見られ、現象層におけるトナー濃度が低くなるので、高濃度の現象が困難になる。又キャリアの平均粒径が小さい場合、キャリア粒子が細か過ぎると、トナー粒子と共に感光体面への付着、飛散を起し易くなる。これらの現象は、現象条件としてのキャリア粒子に作用させる境界の強さ、それに伴うキャリア粒子の強化の強さに大いに関係する。

[0044] また磁性キャリア粒子は、磁性体のみからなっているように、磁性体粒子を樹脂で被覆していてもよい。

[0045] 以上各種検討の結果、本発明に係る2成分系現像剤の磁性キャリアは平均粒径が30~80 μ m、境界500 μ m/sデントにおいて磁化率が20~50emu/gであることが適正条件である。

[0046] 以上のような磁性キャリアに用いられる磁性体としては、鉄、クロム、ニッケル、コバルト等の金属、あるいはそれらの化合物や合金、例えば、四酸化鉄、γ-酸化鉄、二酸化クロム、酸化マンガン、フエライト、マンガノ-銅合金と言った強磁性体乃至は常磁性体の粒子が挙げられる。

[0047] なお、特にキャリア粒子を樹脂等によって形成し、好ましくは球状の形状をもったものとする。ことにより、現象スリープ上に形成される現象層が均一となり、また現象スリープに高いバイアス電圧を印加する

[0053] 更に商品名「HYTEC」(東洋化学工業製)として市販されているポリエチレンワックスマルジョーは同様の目的で用いることが可能である。

[0054] 荷電制御剤も同様に公知の構造のものである。

[0055] 荷電制御剤としては、プラスチックとしてニグロシン系の電子供与性染料、ナフチン酸又は高級脂肪族の金属塩、アルコキシカル化アミン、第四級アンモニウム塩、アルキルアミド、金属錯体、顔料、弗素処理活性剤等、マイナスイオン電圧として電子受容性の有機錯体、塩素化グラフィン、塩素化ポリエチレン、銅フタロシアニンのスルホニルアミド等が挙げられる。

[0056] 以上のように構成された多色画像形成装置において、まず、本発明において良好な現象を行なう現象条件の範囲として、反転現象時に交流現象バイアスの振動電圧V_{p-p}は0.1~4.0kV、前記像保持電圧30と現象用回転スリープ363間のDsdは0.1~0.7mm間を調整させ、直流現象バイアスはV_{d c}=750V、非画像部電圧V_Hは-850V、画像部電圧V_Lは-50V、像保持電圧30の繰返しV_Sは140mm/secに設定した。現象剤D₁について、磁性キャリア径は43.8 μ m、非磁性トナー径は7.9~25.2 μ mに変化させ、ここでトナー現象性がトナー層の層以上は像保持電圧30面に十分付着するようにするため、トナー濃度を6~10重量%の範囲で調整した。次に画像における文字再現性を評価する場合はブラックトナーにより形成された画像により行なう。又、多色像の内蔵色像を評価する場合は一色目にイエロートナーを被覆したトナーとして、次に二色目に* [表1]

目視による解像性評価	
トナー粒径 (黒) μ m	5
5.1	最良
8.1	"
11.5	良
15.2	"
20.2	普通
23.5	悪
26.7	"

[0061] 上記の表は原理として8.0ラインペア/mm、デューティ比50/50をレーザー露光装置で書き込みを各々のトナー粒径を用いて記録紙に画像形成を行なった。該画像形成により形成された画像を目視により、その解像性の評価を基準5、良、4、通常の許容レベル3、悪い2、劣悪1の基準に分けて判定した。この際設定した現象バイアスは、交流現象バイアスのV_{p-p}を変化させて各トナー粒径毎にべた面像を形成し、各トナー

*ブラックトナーを非画像部電圧条件で現像し、混色トナーとして用いる。

[0057] 図3は、前記現象装置36を用いた像保持電圧30の増像部の現象を行なう際、交流現象バイアス(周波数及びピーク電圧)条件のうち画像上にビッチむらが発生する領域を示すデータである。この図3に示したデータで使用するブラックトナー粒径dは8.1 μ mであり、交流現象バイアスのうち周波数が低すぎると画像にビッチむらが発生してしまう。その下限は図のように100Hzであり、ピーク電圧や現象ギャップとの依存性は見られなかった。

[0058] 次に図4は、前記同様に交流現象バイアス条件のうち、文字再現性の良好な領域を算出により算出したデータを示している。本データにおいては、ブラックトナー粒径dは8.1 μ mを用い、本実験においては像保持電圧30と現象用回転スリープ363間、即ちDsdが狭い程、周波数が低い程現象性は改善される。前記Dsdが0.7mm程度まで広くなり、又周波数が高すぎると文字が折れはじめ、文字再現を行なう良好な領域が狭くなる。従って前記Dsdの上限は0.6mmであり、周波数の上限は200Hzである。

[0059] 以上のようにDsdの範囲と交流バイアスの周波数は画像の解像性を向上するのに重要であるが、更に文字再現性を決定する重要な要因としてトナー粒径がある。トナー粒径が小さければ小さい程解像性が向上し、文字再現性が良くなるが、表1はトナー粒径と解像性の関係を調べたデータである。

[0060]

[表1]

粒径毎に1~1.5 μ m程度現像されるV_{p-p}を調べた。その他の条件としては、周波数2kHz、Dsd 0.3mm、直流現象バイアス=750V、非画像部電圧=-850Vに設定した。その結果、トナー粒径が20 μ m以下であれば良好な解像性を有する画像を得ることができた。従ってトナー粒径は20 μ mが上限であることが判明した。

[0062] 図5は粒径8.1 μ mのブラックトナーを用い、像保持電圧30に対する増像のない良好な上限値を示し

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たもので、交流バイアス周波数、 V_{pp} を変化させ、 D_{sd} をパラメータとした場合の良好な画像形成範囲を調査したものである。この調査より D_{sd} が広がれば落雷しにくくなり、良好な画像形成範囲が広がることから分かる。前記図4より D_{sd} は0.6mmが最大値で、従って V_{pp} の上限値は4KVである。

【0063】図6は粒径8.1 μ mのブラックトナーを用い、0.6 μ mの範囲においてトナー1層以上現像される良好な現像性が得られる範囲を調べたデータである。 D_{sd} が前記0.6mmより狭い値に設定すると電界が強くなり、良好な現像性の範囲が広がる。しかし D_{sd} が0.1mmより狭くなると前記現像用回転スリッパ363上の現像剤 D_1 の一部が前記像担持体30面と接触してしまうので、 D_{sd} は0.1mm以下より小さく設定することはできない。従って D_{sd} が0.1mmに設定されたとき、非磁性トナーの付着量が一層以上現像できる良好な範囲の V_{pp} 下限は0.3KV以下であり、実際これ以上で設定して使用される。

【0064】図7は D_{sd} 0.3mmで褐色の発生しない良好な現像条件の範囲を示す。ここで褐色とは、像担持体面に露光を行い現像してトナー画像を形成した後、該画像面に対し、次の露光を行っていない面に不用のトナーが付着することである。且つ褐色は非磁性トナーの帯電量依存性を示すもので、1色目の褐色非磁性トナーと、2色目の褐色非磁性トナーのトナー粒径を同一とし、2色の褐色非磁性トナーの帯電量を調整させて、褐色が発生しない範囲を調査した。まず前記2色目の褐色非磁性トナーの帯電量を低下させると、褐色量が若干減少するが、褐色防止の効果は小さく改善されない。この場合1色目（褐色非磁性トナー）としてイエロー（粒径7.9 μ m、帯電量27.1 μ c/g）を用い、2色目（褐色非磁性トナー）としてブラック（粒径8.1 μ m、帯電量19.2~35.2 μ c/g）を用いて実験を行なった。

【0065】図8、図9、図10は2色目の非磁性トナーを順次大きくしたときの良好な交流現像バイアス範囲を示す。

【0066】まず図8において、 D_{sd} 0.6mm、0.3mm、0.1mmの場合、褐色トナーと褐色トナーの粒径差を0.2 μ m（1色目7.9 μ m、2色目8.1 μ m）とした場合、 D_{sd} 0.6mmに広げて褐色防止に対して有利な場合において、褐色が発生しない交流現像バイアス領域は非常に狭い。次に図9は褐色トナーと褐色トナーの粒径差を0.6 μ m（1色目7.9 μ m、2色目8.5 μ m）とした場合 D_{sd} 0.6mm、0.3mm、0.1mmにおいて褐色しきり良好な領域は広がるが、褐色防止の範囲はまだ狭く不十分である。

【0067】図10において褐色と褐色トナーの粒径差を1.2 μ m（1色目7.9 μ m、2色目9.1 μ m）とした場合、始めて褐色発生しやすい D_{sd} 0.1mmに設定しても十分な交流現像バイアス領域において完全に褐色防止が

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可能となった。従って図10のように褐色トナーと褐色トナーの粒径差が1 μ m以上とすることで褐色を完全に防止することができる。

【0068】

【発明の効果】以上のように本発明は現像装置を用いて像担持体に対し非接触で、且つ直、及び交流バイアス電圧を印加し、各異なった色の非磁性のカラートナーを現像し、該非磁性のカラートナーを重ね合わせて多色像を形成するとき、1色目の非磁性カラートナーより2色目の非磁性カラートナー粒径を大きくすることにより褐色を防止し、文字再現性などの良好な現像電界領域を使用することにより、高品質なフルカラー画像を得ることができる。

【図面の簡単な説明】

【図1】本発明の現像装置を用いた多色画像形成装置の全体の構成図。

【図2】像担持体の表面電位の変化とトナーの現像を示すフローチャート。

【図3】交流バイアス周波数及び V_{pp} における D_{sd} との関係を示す特性図。

【図4】交流バイアス周波数及び V_{pp} と非磁性トナーの D_{sd} との関係を示す特性図。

【図5】交流バイアス周波数及び V_{pp} と非磁性トナーの D_{sd} との関係を示す他の特性図。

【図6】交流バイアス周波数及び V_{pp} と非磁性トナーの D_{sd} との関係を示す他の特性図。

【図7】交流バイアス周波数及び V_{pp} と非磁性トナーとの関係を示す特性図。

【図8】交流バイアス周波数及び V_{pp} と現像条件と D_{sd} との関係を示す他の特性図。

【図9】交流バイアス周波数及び V_{pp} と現像条件と D_{sd} との関係を示す他の特性図。

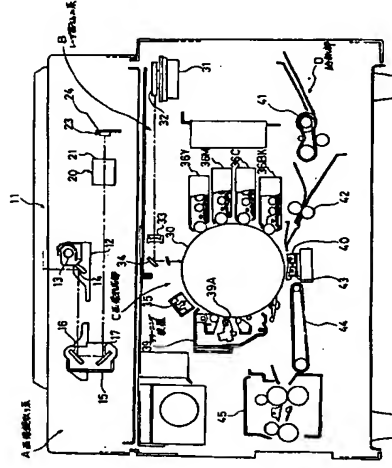
【図10】交流バイアス周波数及び V_{pp} と現像条件と D_{sd} との関係を示す他の特性図。

【図11】本発明に使用される現像装置の断面図。

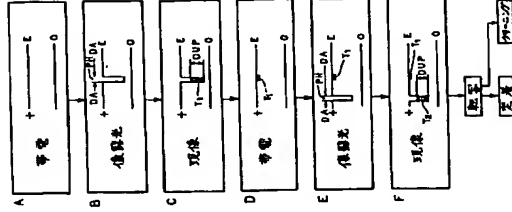
【符号の説明】

- A 画像取り系
- B レーザ読み込みユニット
- C 画像形成部
- D 給紙部
- 11 原稿右
- 20 レンズ群取り部
- 21 レンズ鏡筒
- 23 CCD
- 30 像担持体
- 36 現像装置
- 363 スリッパ
- 369 直流、交流現像バイアス
- 365、366 攪拌部材

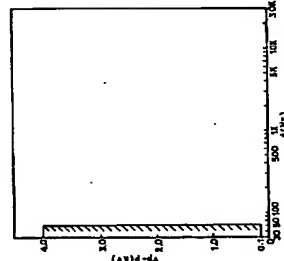
【図1】



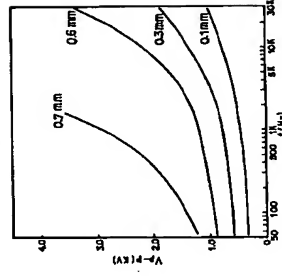
【図2】



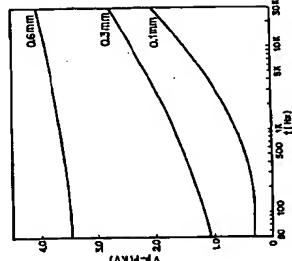
【図3】



【図4】



【図5】



フロントページの続き

(51) Int. Cl. 5

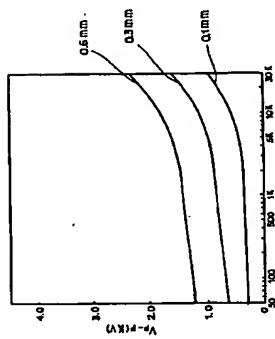
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識別記号 庁内整理番号 F I

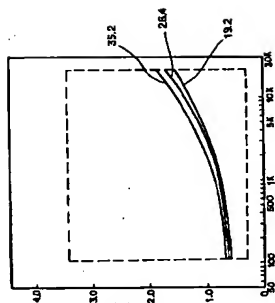
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技術表示箇所

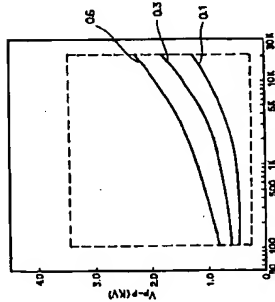
【図6】



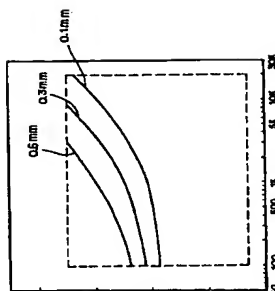
【図7】



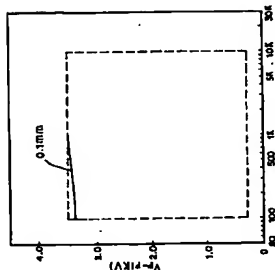
【図8】



【図9】



【図10】



【図11】

